International Conference „ Managing cultural heritage protection in changing environment"

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ProteCHt2SAVE- Decision Support Tools

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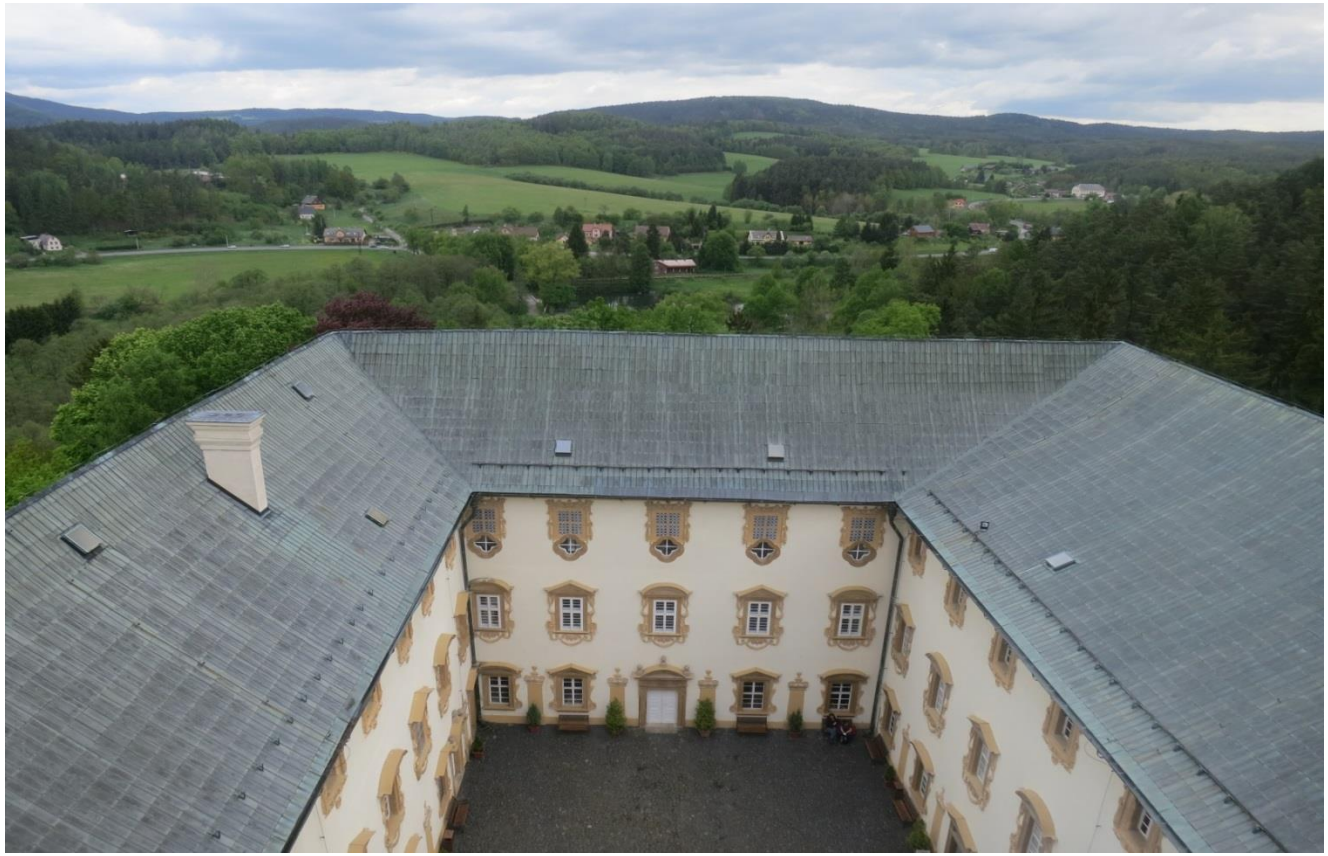
INTRODUCTION

WPT2 CULTURAL HERITAGE VULNERABILITY IN EMERGENCY SITUATIONS:

Target: *CH PROTECTION THROUGH RESILIENCE BUILDING*



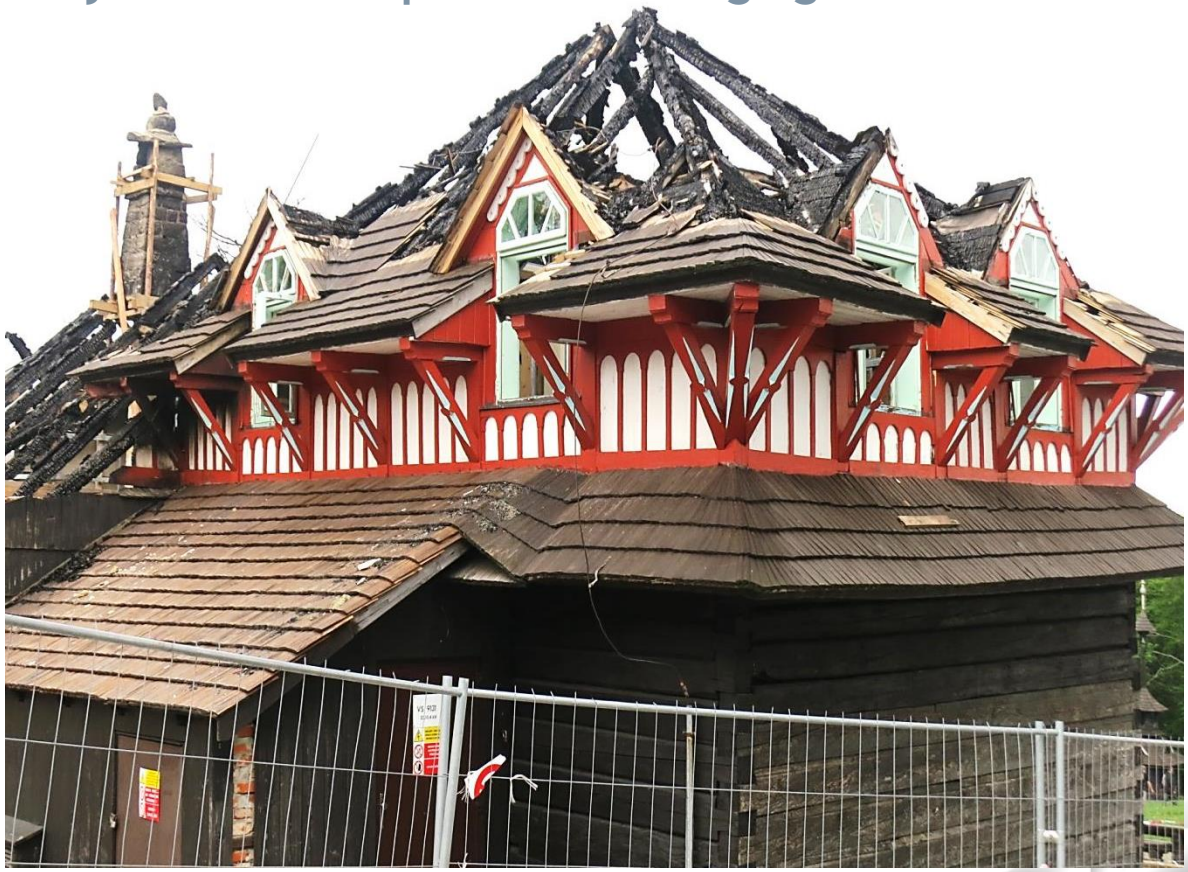
INTRODUCTION

Topic:
VULNERABILITY
"...the extent to which a **system** is **susceptible** to **damaging action**..."
[in: Green 2004]

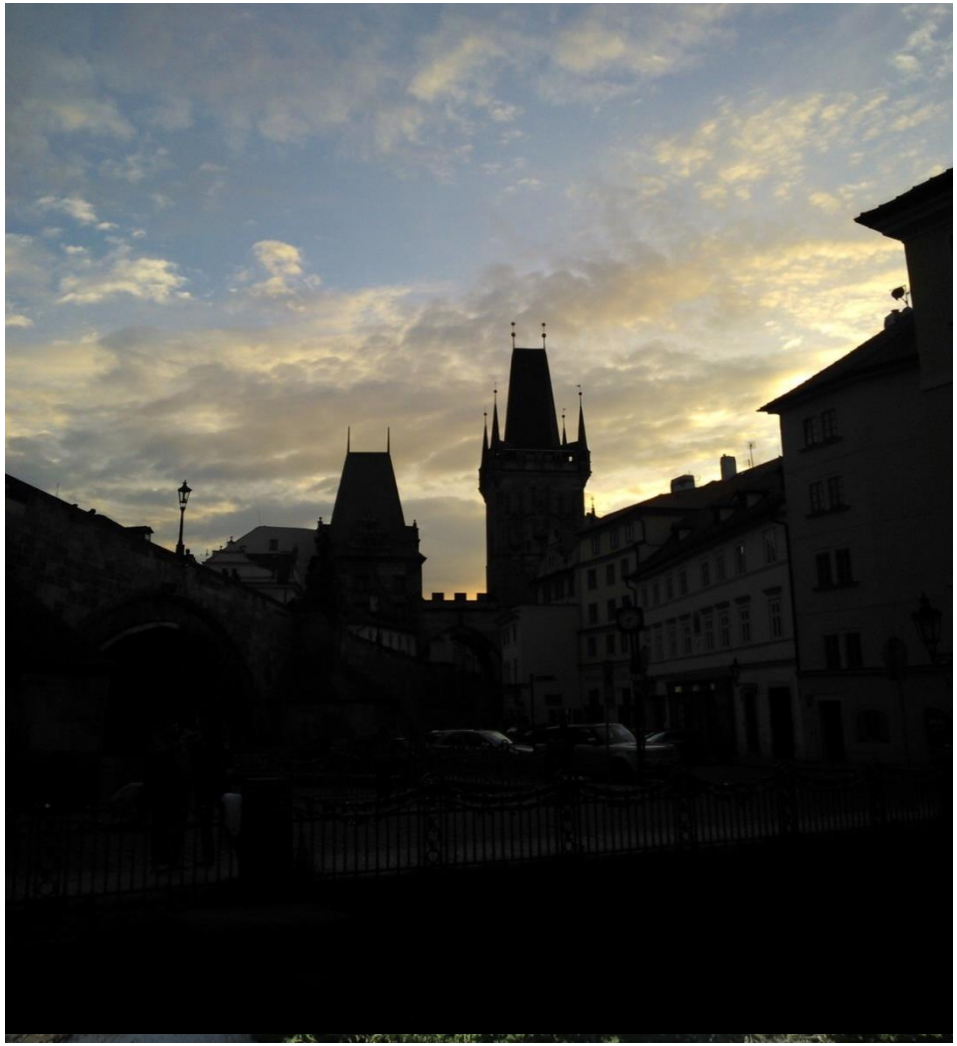
V= Susceptibility

+ Exposure

- Resilience



INTRODUCTION



Focus:
RESILIENCE
" …the **ability** of a system to **absorb** changes without a **transition** to a different state…"
[Cloete 2012]

- Cultural heritage and disasters:
  - **Physical** resilience.
  - **Emotional** resilience.
  - **Cultural** resilience.

- Resilience and vulnerability reduction.

CRITICALITY IN CH SYSTEMS

Any factor or aspect of CH system impacting its **resilience**, i.e. its capacity to withstand shocks without changes.

Controllable features which can be **adjusted** by appropriate **measures.**

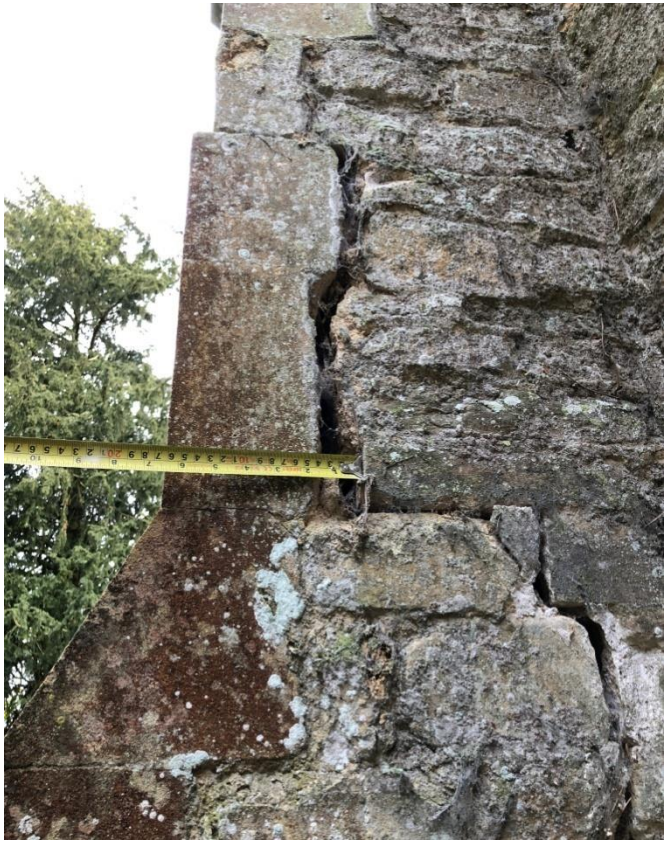
PHYSICAL

Intrinsic characteristics *of CH systems (e.g. material composition, structural conditions).*

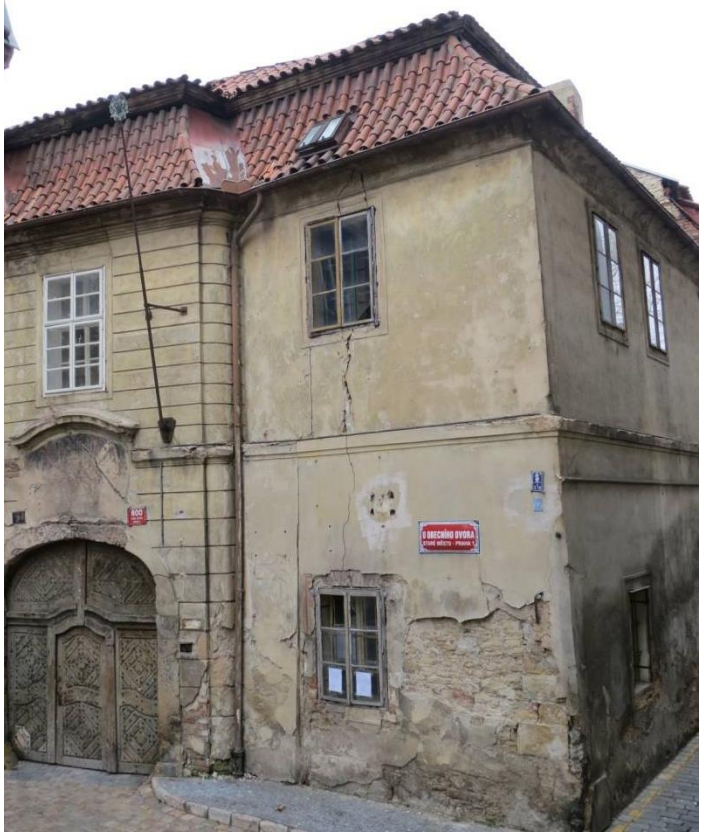
MANAGERIAL

Factors related to the ***operation***, ***administration*** *and* ***care*** *of CH systems.*

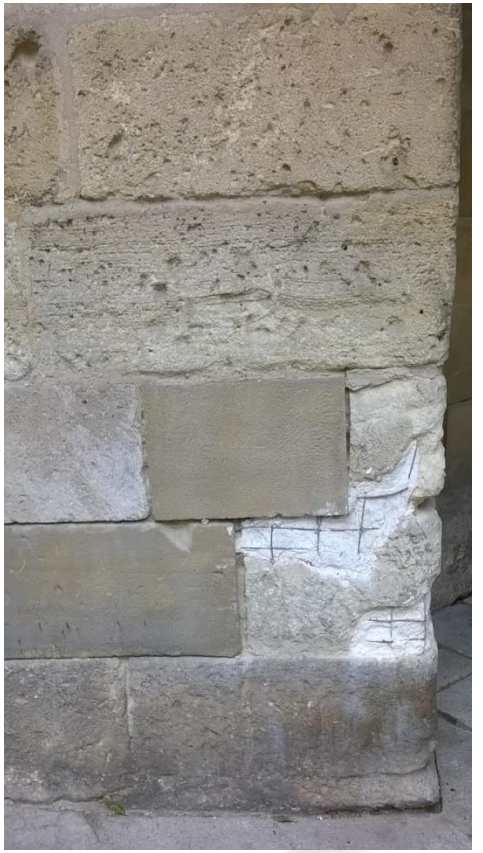
Real-life examples:



Damage.



Lack of maintenance, property issues.



Inappropriate repair, lack of knowledge.

CRITICALITY in CH systems

PROTECH2SAVE CRITICALITY CATEGORIES

MANAGERIAL CRITICALITIES

MC1. Information on CH assets.

MC2. Funding.

MC3. Knowledge and awareness.

MC4. CH protection planning.

MC5. Policy and regulation.

PHYSICAL CRITICALITIES

PC1. Flood.

PC2. Fire due to drought.

PC3. (Wind).

PC4. Heavy rain.

SUPPORT TOOLS- VULNERABILITY & MEASURES

Decision support tool for vulnerability assessment

-MANAGERS-

(D.T2.1.3.)

Manual of good and bad practices

-PRACTITIONERS-

(D.T2.2.1)

CH Resilience manual for self condition assessment

-OWNERS-

DECISION SUPPORT TOOL- 1/6

Decision support tool for vulnerability assessment
-MANAGERS-
(D.T2.1.3.)

WHAT

- Guide for preliminary vulnerability assessment.
- Central Europe transnational criticalities.
- Central Europe specific hazards: Floods, fire due to drought, heavy rain.

WHY

- To support PPs and other managers to assess vulnerabilities in CH systems.
- To allow prioritization of criticalities to be addressed in decision making.

HOW

- Tables ranking level of criticality and relating it to the impact on CH assets exposed to specific hazard situations and possible measures which can be adopted.

DECISION SUPPORT TOOL- 2/6

Rank	Type	Flood Vulnerability	Examples	Preventive measures and priorities
F0	Flood-resistant structures and buildings	No structural or material damage apparent during and after flood. Typical impacts: water saturation and high moisture of materials and structures, soiling, infection by microorganisms, unhinged doors and similar.	Robust objects made of water resistant materials (e.g. granite or similar stone, metals, good stone masonry, concrete).	No hard measures necessary - only some recommended preparedness facilitating cleaning and drying after the flood,
F1	Structures made of materials with a high volumetric change due to moisture	Damage associated with volumetric change - usually irreversible - change of shape, cracks, and deflections. Spalling of surface layers. Moisture expansion may cause damage of masonry - origination of cracks or even shifting structural parts. Bowing of wooden floors. No dangerous loss of strength and load carrying capacity reduction.	i) timber structures and elements, ii) combined structures made of materials with different moisture expansion - e.g. combined timber - masonry objects, iii) some soils	Prevention of contact with water - if possible (plastic wrapping, protective coats etc., creation of dilation gaps between timber and masonry, evacuation of moveable objects.
F2	Structures made of materials that lose their strength to a great extent when subjected to moisture	Materials fast degrading and losing their mechanical characteristics due to high moisture or water saturation which induces significant reduction of load carrying capacity of structural elements or subsoil and may cause fatal failures during flood or after it.	i) dried brick (adobe) masonry, ii) masonry of burnt bricks or some sensitive stones (sandstone) with clay mortars (with a low lime or cement content), iii) decayed timber structures and elements, iv) infill subsoil and fine particle subsoil.	Critical structural elements require assessment of their load carrying capacity by professionals and the structures usually need temporary supports or permanent strengthening before flood situations.
F3	Structures susceptible to partial damage due to flooding	Damage is very sensitive to the condition of such objects. Partial loss of cultural heritage is a consequence of water action.	i) timber parts prone to uplifting and floating away, ii) parts of large bridges, namely parapet walls or piers, iii) pavements	Regular inspection and repair of found deficiencies. Provide temporary strengthening and additional supports; Take measures to decrease loads (dismantle bridge parapet walls, make openings to balance the water pressure); Improve the anchoring of sensitive structural parts into supporting structures; Remove floating objects and "dams" from the stream.
F4	Structures and elements vulnerable to overall collapse or displacement due to flooding	Sudden failure and overall collapse of elements due to the static and/or dynamic actions of water.	i) small bridges and walkways, ii) free-standing walls, iii) light, improperly anchored objects (summer houses, etc.), iv) small dams	

DECISION SUPPORT TOOL- 3/6

Example- Digitalisation of DST in Excel

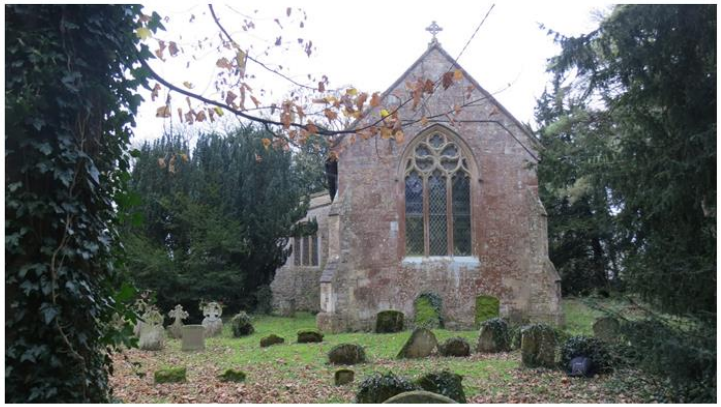
PROTECH2SAVE DST

Please fill in the record data:

RECORD NAME St. Mary Chruch	Date inspection: 12/03/2018
	Name reporter: RC
Address: Buckinghamshire Uk	GPS coordinates:
☐ Moveable asset	☑ Immoveable asset
Description:	
14th century church. Redundant in 1970s. Managed by FFC charity.	

Please insert pictures below (if available):

PICS:



SUMMARY OF REPORTED CRITICALITIES
DO NOT FILL IN ***this field***
This field is automatically filled in following the selection of managerial and physical criticalities
MANAGERIAL CRITICALITIES
MC1. Information concerning CH object:
Select information rank
MC2. Funding avaibility and accessibility:
Select funding rank
MC3. Knowledge and awareness:
Select knowledge and awareness rank
MC4. CH protection planning:
Select protection planning rank
MC5. Policy and regulation:
Select policy and regulation rank
PHYSICAL CRITICALITIES
PC1. Flood:
Select flood rank
PC2. Fire due to drought:
Select fire rank
PC3. Wind:
Select wind rank
PC.4 Heavy rain:
Select heavy rain rank

RECORD DATA | MANAGERIAL CRITICALITIES | PHYSICAL CRITICALITIES

PROTECH2SAVE DST

Please fill in the managerial criticalities reported:

MC1. Information concerning CH object

Click the cell below to activate dropdown menu

INF2- Only partial, not up-to-date or incomplete information exist

Select information rank
INF0- Complete description of CH asset exists and is available to all stakeholders involved
INF1- Partial or complete data existing but not available to stakeholders
INF2- Only partial, not up-to-date or incomplete information exist
INF3- No information about cultural heritage assets (all or one of the following: location, conditions, contents)

Suggested measures and priorities: Perform survey and assessment of damage. Monitoring to be planned for structural damage such as cracks

Rank	Type	Vulnerability	Examples	Preventive measures and priorities
Inf0	Complete description of CH asset exists and is available to all stakeholders involved	No major vulnerability issues. Comprehensive risk management plans can be developed and appropriately shared	Data concerning CH assets are complete (maps, condition assessment of objects and records of contents), accessible to all relevant stakeholders and up-to-date	Regular inspection of assets is required on periodic basis to keep risk management plan up-to-date; Regular maintenance is also necessary to ensure conditions of the asset
Inf1	Partial or complete data existing but not available to stakeholders	Loss might be expected particularly during rescue activities when handling, transportation and storage requirements are not accessible	Examples include information concerning moveable heritage such as collections and artefacts in a museum are not available to rescue units	Records of moveable heritage stored in buildings with data on their location and description for evacuation purposes; Digitalization of CH related data; Integration of existing databases
Inf2	Only partial, not up-to-date or incomplete information exist	Damage is expected to the CH object and its contents. Failure of structural components and loss of moveable objects can occur due to incorrect, missing or not valid information	Maps and databases related to CH assets present in a specific area exist however significant information is missing or invalid due to changes in time of asset vulnerability or hazard level	Regular inspection Identifying and marking stock at risk through mapping; Damage assessment and evaluation; Records of moveable heritage stored in buildings
Inf3	No information about cultural heritage assets (all or one of the following: location, conditions, contents)	Different levels of damage from minor to collapse can occur even in the case of actions of minor intensity. Lack of information can seriously affect the proper determination of safety against natural disaster or weather effects (e.g. in case of weather induced degradation of mechanical properties of material load bearing capacity might be overestimated)	No mapping of CH assets present in a risk-prone area is available. Unknown structural and material conditions of assets. No data concerning valuable contents of buildings are known.	Regular inspection and repair of found deficiencies; Identifying and marking stock at risk through mapping; Damage assessment and evaluation; Records of moveable heritage stored in buildings; Digitalization of CH related data; Integration of existing databases

MC2. Funding avaibility and accessibility

Rank	Type	Vulnerability	Examples	Preventive measures and priorities
Fun0	Funds available and accessible	No major vulnerability issues. Proper measures are financed.	Necessary funds are allocated for the risk management of CH assets including	Regular inspection and maintenance for up-dating priorities and optimising

RECORD DATA | MANAGERIAL CRITICALITIES | PHYSICAL CRITICALITIES

DECISION SUPPORT TOOL- 5/6

PROTECH2SAVE DST

Please fill in the record data:

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Address: Buckinghamshire Uk	GPS coordinates:
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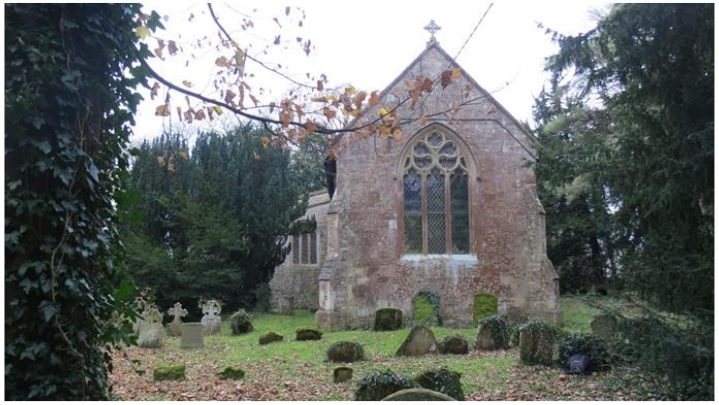


SUMMARY OF REPORTED CRITICALITIES

***DO NOT FILL IN* this field**

This field is automatically filled in following the selection of managerial and physical criticalities

MANAGERIAL CRITICALITIES

MC1. Information concerning CH object:

INF2- Only partial, not up-to-date or incomplete information exist

MC2. Funding avaibility and accessibility:

FUN3- No funds available

MC3. Knowledge and awareness:

KA0- Knowledge and awareness are ensured

MC4. CH protection planning:

PP3- No resilience and risk management plan

MC5. Policy and regulation:

Reg2- Problems with responsibilities

PHYSICAL CRITICALITIES

PC1. Flood:

Select flood rank

PC2. Fire due to drought:

Select fire rank

PC3. Wind:

W1- Vibration prone elements and structures

PC.4 Heavy rain:

R2- Structures and elements exposed to rain and/or heavy rainwater runoff

RECORD DATA | MANAGERIAL CRITICALITIES | PHYSICAL CRITICALITIES

DECISION SUPPORT TOOL- 6/6

WARNINGS

- Tool for reference only (traffic light-like).

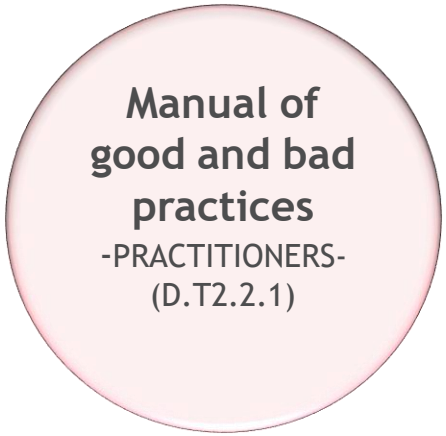
- Preliminary assessment of criticalities.

Professional support is required for accurate assessment and detailed design of measures.

- It does not consider synergies of multiple actions.

Combined effect is always larger than sum of single effects!

MANUAL OF GOOD AND BAD PRACTICES-1/3



WHAT

- Manual with examples of bad and good practice in managing CH risk learned from present and past events.
- Strengths and shortcomings of measures are presented.

WHY

• To support practitioners and managers in implementing adequate mesures which optimize resilience of CH systems under specific risk scenarios.

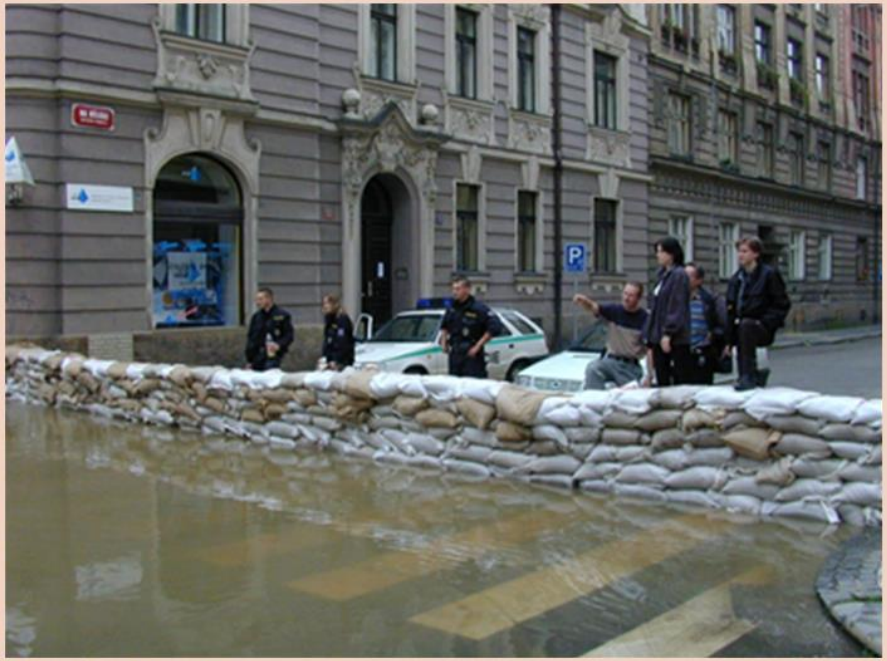
HOW

- „Cards“ with technical details of bad and good practices.

red cards: shortcomings; green cards: resilience building measures.

Data from research literature, technical reports, civil protection guidelines, experience etc.

Evaluation of the effectiveness of emergency measures

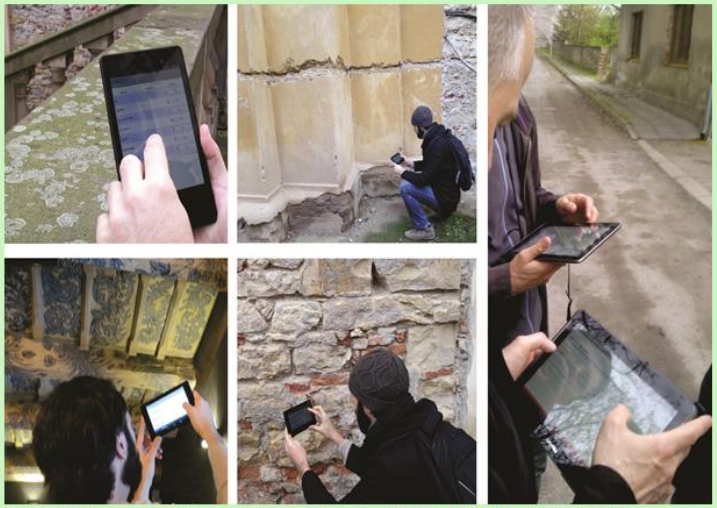


Karlín (Prague/CZ)

Some emergency measures provide a relatively fast and cost effective protection against floods. However, their effectiveness can be limited and it should be always taken into consideration for each measure the safe uses that are allowed. For example, the employment of sand bags is successfully applicable only at low depth and slow velocity of water flow.

GENERAL MEASURES

Cultural heritage mapping, identification and state of conservation

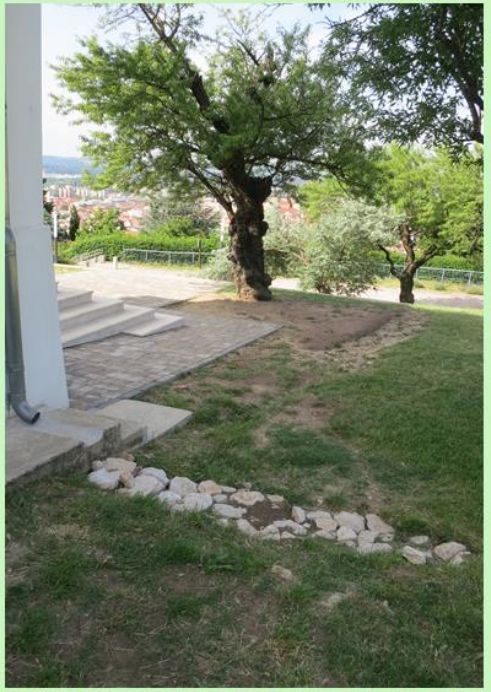


Damage identification using mobile devices (MONDIS project)

The mapping and identification of the CH assets at risk is one of the essential steps in risk evaluation and management. Knowing the location, characteristics and conditions of objects allows better planning and prioritisation. Modern ITC solutions can help to easily record and process a vast amount of data.

HAZARD SPECIFIC MEASURES

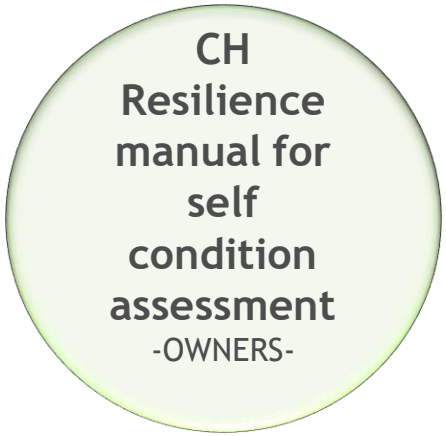
Design and implementation of adequate drainage systems



New drainage system of a baroque church (Pécs, Hungary).

Existing drainage systems should be surveyed and repaired on a periodic basis. New systems, or parts of them, should be carefully designed to allow for the increased rain loads, in case the existing system is deemed not sufficient. In this example, drain pits have been added to the system in order to stop the flowing of water downhill (notice the erosion of the ground due to rain before interventions).

CH RESILIENCE MANUAL- 1/2



WHAT

- Guidelines for self condition assessment of CH assets (built and moveable).

WHY

- To support owners in assessing the conditions of CH systems.
- Resilience oriented.
- Owners & Maintenance.

HOW

- All results from WPT2.
- Forms relating risk scenarios and possible solutions.

HAZARD:

Criticality

Presence of rendered masonries with clay mortars which are vulnerable in flood situations.

Typical damage

Washing out clay mortars from masonry joints after long duration of flooding or due to flow around the surface.

Resilience measures

PREVENTIVE	EMERGENCY	POST DISASTER
Do-it-yourself: Repair all rendering discontinuities or detachments. Render the walls (if possible) with water less sensible mortar or close masonry joints with water resistant mortar.	Do-it-yourself: Wrap the wall in plastic foil for temporary protection against water stream flow.	Do-it-yourself: Support the walls against buckling or failure of outer wall leafs with temporary shoring. Perform deep repointing of the wall.

THANK YOU

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